10/564882
IAP20 Rec'd PCT/PTO 17 JAN 2006

Description

Gas Burner

The invention relates to a burner with a burner head and gas supply channels that are located in the burner head.

Such burners are used, for example, in the combustion of a combustible gas with an oxygen-containing gas in externally mixing burners, i.e., in burners in which the combustible gas and the oxygen-containing gas are routed separately into a mixing zone and ignited there. When using air as the oxygen-containing gas, the burners are conventionally cooled by the air that is drawn in. If technically pure oxygen or oxygen-enriched air is used for combustion, cooling generally takes place with cooling water. For this reason, the burner generally has a cooling channel on its front side and can be supplied with cooling water by way of a cooling water spiral that has been welded on externally.

EP 0 868 394 B1 also describes a gas-cooled burner to which a ring that is made of ceramic or precious metal is fixed to protect the burner head against overly high temperatures.

The mixing zone is conventionally made as a gas phase reactor, and a reactor temperature of from 1300 to 1500°C and a flame temperature of more than 2000°C that has been produced with oxygen can be reached.

Water-cooled burners have the disadvantage that high temperature gradients between the inside and outside of the water-cooled zone can cause major temperature stresses in the material

that can result in the formation of cracks and leaks. Moreover, in typical high-temperature steels, temperature zones form in which a form of corrosion occurs that is called "metal dusting," such that erosion and thus destruction of the burner material take place.

On the other hand, in gas-cooled burners, the application of a ceramic ring to the burner head is likewise associated with risks, since due to the different thermal expansion of the materials, spalling of the ring can take place, and the flow is broken up into eddies on the thicker edge and can lead to the burner head's burning off.

The object of this invention is therefore to make available a burner that is corrosion-resistant even at high temperatures.

This object is achieved according to the invention in that the burner head at least in the area of the exit ends of the gas supply channels consists of an aluminum-containing material.

In this case, steel is suitably used as the base material and is coated with aluminum or an aluminum compound. Alternatively, the material, especially steel, can also contain aluminum as an alloying element. The aluminum content of the material used provides for protection against "metal dusting" and offers adequate heat resistance.

According to one especially preferred embodiment of the invention, a material that consists of an oxide dispersion-hardened superalloy, a so-called ODS material, is used. Superalloys are metallic materials that have especially high heat resistance, especially compared to conventional high-temperature alloys. Oxide dispersion-hardened superalloys contain finely-distributed hardening particles, by which high short-term and long-term mechanical strengths are achieved up to temperatures of 1300°C. By using aluminum as the alloying element in superalloys, moreover, corrosion resistance is guaranteed even at high temperatures by the formation of a self-healing

aluminum oxide protective layer.

A further development of the inventive idea calls for the heat resistance of the burner to be further increased by using an aluminum-containing material in conjunction with a special burner design that always ensures that adequate cooling of the burner takes place solely by the gas flow.

As an essential element of such a burner design, a vane that stabilizes the gas flow is provided in at least one of the gas supply channels. The vane can be formed by a profiled body or by a flat body that is set obliquely against the flow, for example, a baffle. The flow can be influenced in a defined manner by using such a vane in at least one of the gas supply channels. In the channel between the vane and the wall of the gas supply line, the flow velocity is increased and thus the flow is stabilized. The separation of flow filaments and the formation of eddies when the gas streams collide directly in front of the burner head are prevented. The intensive mixing with eddy formation takes place in a delayed manner, i.e., at a certain distance from the burner head. Damage to the burner head by the hot combustion gases that have been sucked in with the eddies is prevented.

The vane is preferably set back relative to the exit end of the gas supply channel. This has the advantage that the vane is located completely within the gas supply channel and thus is flushed in operation only from the gas flowing through this gas supply channel. The flushing gas flow cools the vane especially on its downstream end, and the hot reaction mixture of the two gas flows is prevented from coming into contact with the vane and damaging it.

Preferably, there are different flow velocities for the two participating gas flows since in this way, mixing of the two gas flows is promoted. The action of the vane takes full effect especially when the gas flow with the lower velocity is stabilized by the vane. It has proven advantageous if

the flow velocities of the gases differ by at least 10%, preferably at least 20%. The absolute flow velocities are preferably between 10 and 200 m/s and especially preferably between 20 and 100 m/s.

Advantageously, the gas supply channels are made from gas supply tubes that are arranged coaxially to one another. In this case, there are at least one combustible gas supply tube and one oxidizing agent supply tube. The combustible gas supply tube preferably forms the outside tube that surrounds the oxidizing agent supply tube. In this case, the absolute velocity in the inside tube should be between 10 and 200 m/s and especially preferably between 20 and 100 m/s, while the velocity in the outside tube should be between 7 and 180 m/s and preferably between 16 and 80 m/s. The ratio of the velocities of the oxidizing agent flow and fuel flow should be in the range of 0.8 to 1.8 and especially preferably in the range of 1.0 to 1.3. The cross-sections of the gas supply tubes are established based on these recommended gas velocities. For better mixing of the gas flows after emerging from the gas supply channels, at least one gas supply channel can be provided with means for producing a swirl flow. Here, these means preferably have flow channels that are tilted tangentially against the direction of flow. The means for producing a swirl flow can be made adjustable in order to produce swirl flows of varied intensity.

To further cool the burner, in the outside area the burner can have means for cooling by a vapor flow. Moreover, the burner can be shielded against heat radiation toward the combustion chamber side, e.g., by a diffusor or cylindrical tubular insulation.

Due to the high temperature stability of the burner that is achieved with the invention, a cooling water circuit can be saved, by which susceptibility relative to cases of interference is also reduced. Moreover, the burner is protected by the aluminum-containing materials against the form of corrosion called "metal dustings" such that the service life of the burner is greatly increased. In a

malfunction without throughflow of gas, the especially high temperature stability also ensures that the burner does not melt as long as the reactor temperatures are below 1400°C.

The burner according to the invention is especially suited for chemical reaction of gaseous starting substances into a reaction product at very high reaction temperatures. Especially in the case of gasification of hydrocarbons that are reacted with oxygen or an oxygen-containing gas at higher temperatures, an adequately high temperature stability and corrosion resistance are ensured with the invention.

The invention is to be explained in more detail below based on one embodiment that is diagrammatically shown in the drawing.

The figure shows a section through a burner head. In the burner head, there are two concentric gas supply tubes. In this embodiment, the fuel is metered in the outer annulus 1, and the oxidizing agent is metered in the inside tube 2. For better mixing of the flows, the latter are swirled by means of swirl bodies 3 and 4. So that the combustible gas flow in the exit area 6 is good, a preliminary vane 7 is mounted on the inside tube; this ensures that sufficient cooling of the burner head, especially in the exit areas 5 and 6 of the gas supply tubes, is ensured solely by the gas flow.